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September 4th.

MR. PHILLIPS in the Chair.

A letter was read from J. W. Dawson, Esq., of Pictou, Nova Scotia, accompanying a communication on the "Wheat Midge," as found in that country. The letter was referred to Dr. Leidy, Prof. Haldeman and Dr. Zantzing.

Also a letter from the Rev. Thomas S. Savage, covering a communication entitled "Observations on the species of *Termitidæ*, of West Africa, described by Smeathman as *Termes bellicosus*, and by Linnæus as *T. fatalis*." Referred to Dr. Zantzing, Prof. Haldeman and Dr. Hallowell.

September 11th.

Vice President MORTON in the Chair.

On leave granted, the Committee to which was referred Prof. S. F. Baird's paper, entitled "Revision of the North American Tailed Batrachia," presented a report, recommending the same for publication in Part 4, New Series of the Journal, which was adopted.

A letter was read from the Secretary of the Imperial Society of Naturalists of Moscow, dated May, 1849, accompanying the donation of Nos. 3 and 4, for 1848, and No. 1 for 1849, of the Bulletin of that Society.

September 25th.

Vice President MORTON in the Chair.

A report was presented from the Committee on Proceedings, in reference to the sales of copies of Say's American Conchology, effected since 1844, and the purchase made with the proceeds, of works on Conchology, for the Library, in accordance with the instructions of the donor, Mrs. Lucy W. Say.

The statement made in the present report and in a previous one in 1844, exhibited a total of \$85.50 received since 1841, for copies of Say's Conchology, and a total of \$78.30 expended for works on Conchology added to the Library. The following is a list of the latter:—Donovan's British Shells, 5 vols.; Herrmannsen's Primordia (as far as published); Nillson's Hist. Mollusc. Sueciæ; Philippi's Enumeratio Mollusc. Siciliae; Anton's Catalogue of Shells; Michaud's completion of Draparnaud; Morelet's Molluscs of Portugal; Potiez and Michaud's 'Galerie des Mollusques'; Risso's Molluscs of Southern Europe; Beck's Index Molluscorum; Froriep's Mollusca; Müller's Index Molluscorum Groenlandiæ, and the last volume of the Brussels reprint of Deshayes' edition of Lamarck.

The Committee to which was referred Mr. J. W. Dawson's commu-

nication on the "Wheat Midge" of Nova Scotia, reported in favor of publication in the Proceedings.

Notices of specimens of the Wheat Midge from Nova Scotia.

By J. W. DAWSON.

This destructive little creature has, within the last four or five years, extended its ravages to Nova Scotia. It made its appearance first in the western counties, and has gradually extended its limits eastward. It is now found in every part of the Province, and has, in some districts, caused an almost total abandonment of wheat culture. The specimens accompanying this notice, were reared from the larva state; and as I believe this has not often been attempted with success, I shall shortly state the means by which they were obtained.

When I first became acquainted with this insect, I procured specimens of the full grown larvæ and placed them in a phial, with the view of observing their assumption of the perfect state in spring. None of them, however, appeared, and I subsequently learned that similar experiments had been tried without success; the belief among entomologists being, that the larva descends into the ground to complete its changes. I could not, however, ascertain that this belief had been confirmed by actual experiment or observation.

To satisfy myself on this point, (obviously of importance in reference to the means which may be devised for destroying these animals,) I obtained a fresh supply of the larvæ in that motionless and apparently torpid state in which they are found in the ripe wheat in autumn. In the month of November, a few dozens of these larvæ were placed on the surface of moist soil in a flower pot, in which a carnation was growing. In the course of two days they had, with the exception of a few which were crushed or otherwise injured, descended into the ground, leaving their delicate membranous cases on the surface. Their power of burrowing having been thus ascertained, they were allowed to remain undisturbed during winter, the spot where they had disappeared being covered with a glass shade. During winter the flower pot was watered as the growth of the carnation required.

A similar experiment having been tried in another pot, the insects were sought for in the ground after their disappearance. Very few were found, and these had still the larva form. They were, however, most flexible, and showed some degree of activity. On being placed on the surface, they endeavored to burrow, by means of a worm-like motion, and in doing so they seemed to have the power of fixing the anterior part of the body pretty firmly to the soil. They were found to have penetrated to the depth of about an inch. It thus appeared that the stiffness and torpidity of the larvæ in the ripe grain, are but temporary, and that when they fall from their place within the chaff scales, upon the moist ground, and cast their skins, they acquire the activity and strength necessary for penetrating into the soil, while still in the larva form.

The insects were not again seen until the last week in June, when they began to appear in the imago state, and as early as the tenth of July the whole had emerged. At that date there was no wheat in blossom in this vicinity, but the development of the insects had probably been hastened by the warmth and shelter of the house. The emergence of the midges appeared to take place in the eve-

ning, but was not actually observed. After they had taken wing, their pupa cases remained projecting from the ground, and were white and membranous. When examined by the microscope, they showed the true chrysalis form, the wings and other external organs being distinctly marked on them.

The remainder of the larvæ procured in autumn having been kept dry in a paper box, have lost their orange color, and appear to be quite dead, moisture being apparently absolutely necessary to their entering on the pupa stage.

The insects obtained in the above described manner, were of both sexes. The females agree in their characters with the figures and descriptions of the European *Cecidomyia Tritici*.* The males, which I have not seen figured or described, are distinguished by their smaller size, differently formed abdomen, and longer and more hairy antennæ.

I am not aware whether the mode of hybernation of the wheat midge or "weevil," is generally known to farmers in the United States. If not, it is well worthy of attention, since, by cutting the wheat early, and carefully collecting the larvæ contained in the chaff, and dust separated from the grain, a large proportion of the ensuing year's brood may be destroyed. On the other hand, if the larvæ be allowed to be scattered over the fields or barn-yard, a plentiful supply of "weevils" for the next crop is secured. This method was proposed several years since by Prof. Henslow, but I have not been able to ascertain whether it has been used extensively in America.

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The Committee on the following paper, by Dr. Savage, reported in favor of publication in the Proceedings :

Observations on the species of Termitidæ of West Africa, described by Smeathman as Termes bellicosus, and by Linnæus as T. fatalis.

By T. S. SAVAGE.

Having read a condensed account and many extracts from the communication of Dr. Smeathman to the Philosophical Society of London, on the insect in question, it seemed to me that no room was left for the discovery of additional facts. But, residing in the locality of the Termes, I felt a desire to know personally their economy ; first, from motives of interest in the general subject of Natural History ; and secondly, in order to discover some way of preventing their supposed attacks on our buildings.

As I proceeded, I noticed some mistakes made by Dr. S., or his many copiers, which induced me to record my own observations. Of these the following is a summary.

I would here remark, that I have never seen the original nor entire publication of Dr. Smeathman's paper ; but, what I have seen, is sufficient to show that he was an acute observer, a man of indomitable perseverance, and accurate to a remarkable degree. The best account that I have read of his paper, is that of Edward Newman, Esq., F. R. S., in his "Familiar Introduction to the History of Insects." It is free from the marks of a prurient imagination, and indicates

* Curtis, Journ. of Agric. Society, England.

more of a desire to relate the simple truth in the history of the insect, than any that I have seen. The figures, however, which stand at the head of his account, are decidedly bad.

The first thing that strikes a visitor who is familiar with Adamson's and Smeathman's observations, when he arrives on the coast of Africa, is the great sparseness of the Termites' hills. Instead of "acres so thickly covered, as to appear like the huts of native settlements," his eye may wander over acres *without seeing one*; one cause of this sparseness may have arisen to some extent, from the introduction of civilization. The visitor usually lands first at the European or American settlement, where the hills in their immediate vicinity are mostly destroyed. This has been done, first, from the notion that the insect "ate down their dwellings;" and, secondly, from the superiority of the clay of which they are constructed, which is used for building purposes. At no point, however, between Cape Verd and the Gaboon river, will the stranger remark them for their numbers.

They more frequently occur on plane and flat lands; making their appearance especially soon after the lands have been cleared for planting, at which time trees are left girdled and prostrate to decay.

The features which first strike the beholder are their great size and form. These have been well represented by Smeathman, though two hills cannot be found exactly alike. Their contour is generally that of a hay-stack—the surface never regular, always marked with protuberances and upward projections, often not unlike "turrets," as termed by Smeathman.

Sometimes the hill presents the aspect of a mound having been worn down by the heavy rains, or, if in the vicinity of a village, by children playing upon it. In such cases they may be forsaken.

When they present distinct upward projections, or turrets, they are known to be in the process of enlargement. This is always the mode in which these insects increase their domicils. Turrets are projected one after another, and the intervening space filled out, so as to make a continuous surface. Within each of these turrets is a cavity which leads down as a passage, into the interior of the hill, or terminates in some other passage, keeping up a free communication throughout the structure. When hills present in their general outline the form of a hay stack, they have arrived at their maximum size. Their height in such cases is from 12 to 15 feet perpendicular measurement, the circumference at base from 50 to 60 feet; at two-thirds the height, or around the base of the "dome," from 30 to 40 feet.

The materials have for their base clay generally strongly tinged with oxide of iron in the recent state; after exposure to the sun and atmosphere, it takes on a light color, approaching a dull yellow, in some cases white. There is an admixture, more or less, of other substances incidentally occurring, as gravel, leaves, straw, &c.

Sometimes the clay presents a dark, slaty aspect, which is incorrectly stated in books to be an indication of a different species of insects. This fact is owing to different colored clays, existing in different localities.

The strength of these structures is incalculably great; as an evidence of this, Smeathman states that they are often mounted by wild bulls, and four men were known to stand on one to spy a vessel at sea. But more than this, *they would*

sustain more wild bulls and men than could possibly mount them. The particles of clay are cemented together by a fluid excreted from the mouth of the insect (not as Smeathman says, by gums elaborated from the different kinds of wood on which they feed). This, by exposure to the sun and atmosphere, becomes exceedingly hard and tenacious on the surface, added to which, the action of the well known principle in mechanical philosophy involved in the arched form of the structure, gives to it a vast degree of strength. This feature in the economy of the *Termes fatalis*—the strength of the domiciles—is a wise provision in nature. It guards the hills against the heavy, wasting rains of the country, and enables them to resist the shock of decayed falling trees, which so often occur on recently cleared grounds. When it is known that it is the practice of the natives of Africa not to plant the same piece of ground two years in succession, but let it lie fallow four or five years, and clear up a new spot every year, and as many trees are girdled and left to decay and fall, the wisdom of this feature will be understood.

On clearing away the shrubbery and grass around the base of a hill, several covered ways or clay tubes will be seen leading to neighboring stumps and decayed logs. These tubes, sometimes 12 inches in diameter at base, gradually diminish, ramifying, as they proceed outward. If their connection with the hill be broken, as many holes will be seen, constituting mouths of passages which run in a sloping direction to a depth of 12 or 18 inches under the domicil. These passages expand into basement rooms, bounded by clay pillars, supporting a series of arch-work on which rest the "cellular work," "royal apartments," and super-incumbent interior portions of the structure.

The exterior of the hill consists of a clay wall varying in thickness on the different sides from 6 inches to 1½ feet. Throughout this wall there are cavities, cells and passages, anastomosing and running from the base to the apex, forming a communication with the "dome." Within, at the base, elevated to a height of *one to two feet above the surface of the ground*, and central in respect to the circumference of the hill, is the apartment of the king and queen, styled by Smeathman "the royal chamber," surrounded by many other apartments or chambers, containing eggs and young of various sizes and stages of growth, all supported by the arch-work mentioned.

It will be observed, that Mr. Smeathman states that the "royal apartments" are on a level with the surface of the ground; but, *in every case*, I have found them elevated from one to two feet, depending on the height of the structure. Indeed, at certain seasons, this elevation becomes a matter of necessity in many localities. Were it otherwise, the royal pair would be in danger of inundation during the long and violent rains of that country.

Immediately above the royal apartments, extending across and up the sides of the hill, to about two-thirds their height, are the "nurseries" of Smeathman, a yellow, dry, comb-like, granulated substance, enclosed in moist red clay, so moist that it can be made by the hands into balls. In this substance are numerous narrow serpentine cavities, or cells, containing eggs and young in different stages. Scattered on the surface are perceived, in a recent state, many minute white globular fungi. Immediately above, and interior to the nurseries, lie the "magazines" of Smeathman, rising to the height of about a foot. These are a cellular arrangement of soft clay, filled with a dark-brown granulated substance,

supposed by Mr. S. to be the "food." It is very moist, and appears to be vegetable substance, comminuted and reduced to this state by the insect.

Between the royal apartments and nurseries, is the first floor of Smeathman: immediately above the magazines, is the *second*, then comes the "dome," a large cavity in the upper part of the structure. With the dome there is a communication by numerous passages with the different parts of the hill, and thus a free circulation of warm air kept up, giving a uniform temperature to the domicil. The principles of philosophy known in the tendency of air to an equilibrium, its ascent when rarified, condensation and descent in coming in contact with a colder medium, thus securing a uniformity of temperature, are all involved in this peculiarity of structure.

The statement of Dr. Smeathman respecting the primary size and subsequent mode of increase of the royal apartments, is a matter of deduction, though undoubtedly correct. In small hills the queen is found of corresponding size. As the hills increase, the size of the queen and her apartments are known to increase. The adjacent portions must be taken down to meet this enlargement. This is true also of other portions of the structure. As the outer projections, or turrets, are sent up from within, and the intervening spaces filled out, a portion of what was previously the exterior, must be removed to admit of the expansion of the interior arrangements, the nurseries, magazines, &c. This change and removal must be more or less true also, of almost all parts of the domicil.

The community was divided by Smeathman into three orders; 1st, the workers, 2d, soldiers; 3d, the perfect insects, male and female, or king and queen; a fourth order, or state was subsequently noticed by Latreille among other species in the south of France, at Bordeaux, (*Termes lucifigus*.) It was afterwards observed in the East Indies, and incidentally noticed by an anonymous writer in manuscript on a Ceylonese species (Kirby and Spence's *Introduct.*, 2d vol. 33 p.) This was the nymphal or pupal state of the *workers* in which rudimental wings were observed. The same state was inferred and averred of *T. fatalis*, by Messrs. Kirby and Spence, and adopted by compilers. I have never known this inference to be confirmed by any observer, writing on the African species; but, I am happy in being able to assert the fact from personal observation, and, furthermore, to declare the *same of the soldiers*. I have seen both with rudimental wings distinct. Messrs. Kirby and Spence suppose the pupæ to be equally active with their respective larvæ, which is not the case; they are exceedingly delicate and sluggish.

Of these several orders, the laborers are by far the most numerous. They seem to be susceptible of two divisions—*larger and smaller laborers*. The latter exceed the former in numbers, and are found chiefly in the domicil. The work about the hill, such as constructing, repairing, bearing away the eggs from the maternal department, &c., seems to be done by them. Of the larger size, some few are found in the hill, but they exist in greater numbers in the covered ways, about and in the objects of plunder. The mandibles of this division are very hard and strong, and admirably adapted to the performance of what I suppose to be their part in the community, which is the comminuting of the different kinds of wood on which they prey, and the reducing of the clay from which their hills are made, to a portable condition. A like division of labor I have noticed among the Driver ants of Africa, (*Anomma arcens*, and *A. rubella*); Messrs. Kirby and Spence are incorrect when they say (*Introduct.*, 2d vol., p. 40–41,) that "they

carry in their mouths a mass of mortar half as big as their bodies, ready tempered, made of the finer parts of *gravel*, which, worked up to a proper consistence, hardens to a substance *resembling stone*, of which their nests are constructed." The amount each insect carries at a time, is so small as to be hardly perceptible to the naked eye. When the work is done, it presents a minutely granulated appearance, like that of the "nurseries." Nor is it already "*tempered*," ready to be laid. The insect, when it arrives at the place of deposit, stops for an instant, and retaining his hold on the piece of clay, undergoes a slight tremulous movement, more perhaps like the spasmodic action of vomiting, when *a fluid being seen to be excreted from the mouth* over it, the clay is deposited. This corrects the supposition of Smeathman, that the cementing medium was gum obtained from the trees on which they preyed. The outer surface of the work, when recent, presents a red, moist, granulated appearance, but when acted on by the sun and atmosphere, it approaches a dull white, or yellow, and is highly indurated, more so than simple clay dried in the sun can be. It however, falls far short of the hardness of stone; as the hill is penetrated, the clay becomes softer until the interior is found to be so plastic that it can be made into balls under the pressure of the hand. The young of this order are seen of all sizes: the *nymphæ* of Latreille differing from the others apparently in no respect but that of their rudimentary wings.

Soldiers.—Of this order, there seems to be ground for two divisions also, *larger and smaller*.

When a breach is made in the hill, the smaller soldiers are seen with the laborers in small numbers, and retreat with them to the interior. Then appear the larger soldiers, whose duty especially it is to defend the community. Their conduct, ferocious aspect, &c., have been well described by Smeathman, and need not be here repeated. It has been said, however, whether by Mr. S. or not, I cannot state, that in the act of biting, "they never quit their hold even though they are pulled limb from limb," (Kirby and Spence, *Introduct.*, vol. 2, p. 40.)

This assertion has been correctly made of the Driver ants of Africa, (*Anomma arcens* and *A. rubella*), but cannot be of the *Termes fatalis*. It is the habit of this insect to let go immediately after biting, and strike as fiercely at another place, doing this several times in quick succession. The manner in which its jaws operate, will not admit of a continued hold. Like scissors, (unlike the mandibles of the *Anomma*,) they cross each other, separating the fibres by a clear cut through.

In about fifteen minutes after the attack of the enemy, the work of reparation begins by the laborers, who, accompanied by a few of the smaller soldiers, and occasionally a larger, appear in great numbers. In view of the duty performed by these two orders, it is a surprising fact that both males and females are without eyes.

These at particular seasons, leave the hills in vast numbers. "The rains," as they are familiarly termed in Africa, begin in May, sooner or later, and continue with some intermissions until October. During the month of July, and sometimes extending into August, an intermission takes place under the name of "middle dries," dividing them into "early and latter rains." At the beginning of these seasons—"early and latter rains,"—the *Termes swarm* (if it may be so called,) in incalculable numbers. At their exit, so rapid is their ascent, that they present the appearance of smoke rising from all parts of the hill. The holes through

which they escape, are temporary, created for this purpose, and closed when the *swarming* ceases. During this process, the atmosphere for many rods distant seems to be filled with them. Birds are then seen whirling and darting through the air in quick pursuit—all orders of insect-eating animals, are now on the alert. Barn yard fowls are seen to jump up several feet from the ground to catch them as they descend. Indeed, men as well as brutes, make them their prey. All tribes of Africans, however, do not eat them. The Grebos, who inhabit Cape Palmas, and among whom these observations were made, reject them as food. Why, it is difficult to tell, unless it be from the trouble attending their capture. It is not from any fastidiousness of taste, for they are known to eat snakes, toads, grubs, beetles, and even putrid meat, with zest. Tribes about fifty miles to the windward of Cape Palmas, use them as food. To catch them, bowls of water are set on the ground, into which they fall as their wings drop off. They are then roasted as shrimps, and the larger beetle (goliathi) are said to be equally sweet.

The individuals of the two sexes appear to be about the same size when they issue from the hill, *not exceeding half an inch*. The largest queen I have ever seen at the head of a community measured $4\frac{3}{4}$ inches in length.

Messrs. Kirby and Spence state that the queen lives but two years, which is incorrect. I have observed the yearly increase of hills for *five years* or more, and, when dissected, they have yielded a queen of corresponding size. To say that a successor to the original one might have been elected, would be gratuitous. Nothing is known of their habits to warrant such an assertion, while everything we do know goes to prove that they live for many years.

It is stated also, that but one queen is ever found in a hill. This, too, is incorrect. But one is generally found. I have known two to occur. They were contained in the same structure, called by Smeathman "the royal chamber," but separated by a septum of clay. The hill was of the usual size. It was "dug down" by a colonist at Cape Palmas, who, knowing that I was investigating the habits of the insect, kindly brought them to my residence. I regretted exceedingly my inability to decide the question which arose to my mind at first sight, "Is it a case of bigamy?" The person who discovered them took no notice, and was unable to say that he saw even one king. It occurred to me that it might be an anomaly. I therefore made inquiries at *Mont Serrado*, and the different European settlements that I visited, and ascertained that the same thing had occurred at those points, though it was considered quite unusual.

I am able here to confirm the truth of Mr. Smeathman's statement, that the king and queen are permanently enclosed in their apartment, which has been doubted by the eminent writer of the article *Termitidæ*, in the British Cyclopædia of Natural History, (understood to be J. O. Westwood, Esq.)

The sentence in which the doubt occurs, runs as follows: "The young queen of the hive swarms, is followed by a portion of the community; and the female after swarming, and the loss of her wings, is guarded by the worker ants; there is, therefore, so much analogy in these circumstances, that we are almost tempted to consider that Smeathman must have erred in stating that the working Termites imprison both the king and queen Termites. That it should be necessary for the latter to be carefully guarded, will be very evident; but why the king in his helpless and wingless state, (for we consider that the loss of wings is consequent

upon and not precedent to pairing, should be shut up, seems questionable. We make these observations with hesitation, because Latrielle and Kirby and Spence seem to adopt, without hesitation, this statement of Smeathman."

I feel it my duty to notice particularly this doubt, coming as it does from a source of such high respectability as the present Corresponding Secretary of the London Ent. Soc., J. O. Westwood, Esq.

It should be remembered that in penning this doubt, Mr. W. was sitting within doors at Hammersmith, Eng., many thousand miles distant from the scene of Mr. Smeathman's patient and prolonged observation. Mr. S. states what he *knew to be a fact*, and, respecting which, I can see no way in which he could be mistaken. Mr. W. misapprehends a remark of Mr. Smeathman on their "swarming," if it can be so called. I do not understand Mr. S. to state that the queen is accompanied by any other individuals than those of the two sexes—other perfect *males and females*. He says that as *workers* are always to be found on the *surface of the ground*, the king and queen are *captured by them*, and thus made to become the heads of new communities. On what foundation *this* statement rests, I know not; but must confess that in this part of their economy I think there exists a *lucuna* yet to be filled. As to the statement, however, involving the perpetual imprisonment of the king and queen, I have no doubt. The facts respecting the structure of the "royal chamber" sufficiently prove it. Any one who has seen a fully developed queen, will say that she is incapable of progression, and the fact that no aperture has been discovered in the "chamber" among the many hills dissected at different seasons, sufficient to admit of the ingress and egress of the king, and hardly of the larger class of soldiers, must suffice.

It has been stated also by compilers of Smeathman, that the insect shrinks from light, which is a reason for their constructing covered ways. But, if it be remembered that the two orders—soldiers and workers—are perfectly blind, the assertion must appear to be gratuitous. The true cause of their erection of covered ways would seem to lie in the fact that the insect is a prey to a vast number of other insects, reptiles, &c.

Smeathman and others state that *Termes bellicosus* is the insect which devours dwelling houses, furniture, &c. This also I consider an error. I doubted its accuracy at the inception of my observations, and made inquiries subsequently of intelligent observers at Sierra Leone and Montserrado, all of whom confirmed me in my doubts. The white ants found in our houses, preying on our furniture, books, &c., are *smaller*, and larger in proportion to their breadth than *T. bellicosus*. The soldiers which accompany the laborers and found with them in their covered ways along the sills, floors and roofs of our houses, differ palpably in these respects from those of *T. bellicosus*. I made known my doubts on this point to my correspondent, Mr. Westwood, of London, proving the truth of my statement by specimens taken from my own dwellings, but, unfortunately, the bottles containing them were broken, and I failed of my object. I consider these *house eaters* as the *T. arborum* of Smeathman. One of their nests, indeed, I found in the roof of my office, and by them great damage was done to the building, besides many books were destroyed, having been eaten through and through. Another nest also was found in a small outbuilding; the insects of these two nests corresponded to those found in my dwellings, &c., while marked differences existed between the latter and *T. bellicosus*. I regret exceedingly that the steps to prove this opinion have failed in the manner above stated. I hesitate not, however, to assert it, confirmed as it is by other observers.

Hills dissected.

First hill opened 22d March, 1842. General outlines very much like those of a hay stack: situated in a valley.

Measurement.

Circumference at base,	34 ft.
“ at $\frac{2}{3}$ height from the base,	25 ft.
Height from apex to base on the surface,	13 ft.
“ “ “ perpendicular,	9 ft.

The work was begun with three men at 20 minutes past 4, P. M., and required $2\frac{1}{2}$ hours to accomplish it.

The material was red clay obtained about two feet below the surface soil, the latter being a mixture of sand and decayed vegetable matter brought down from the surrounding hills. The surface was highly indurated, receiving a slight impression from a single blow of the mattock.

The order first seen was the workers, who instantly retreated on exposure to the external air. They were succeeded by one and then another, and then many of the larger class of soldiers, who, rushing out in great rage with jaws extended, threatened vengeance on the intruders.

The experiment of permitting them to bite was tried several times, when it was perceived that a drop of brownish fluid was exuded upon the part. The sensation was like that of a minute sharp cutting instrument, the jaws moving in cross direction like scissors.

On breaking several of the upward projections or “turrets,” they were perceived to be hollow, leading into the “dome,” and the main passages in the walls down to the basement. These several passages were smooth, as if by being well worn by constant tread, and it undoubtedly is through them that their food is brought from below to the “magazines.” The first fragment of the hill exposed numerous apparent perforations, from the size of a shot to that of a dollar, which were increased by every stroke; these were the different passages, running in every direction and anastomosing with each other, keeping up a communication throughout the domicil.

The walls seemed to be about twelve inches thick, and contained numerous cavities or cells of various sizes and shapes, with young in different stages of growth, extremely white and delicate. They communicated with each other and with the main passages. The number of young contained in them varied from twelve to twenty. When several were found in one cell, they were regularly and closely packed, with their heads converging towards the bottom. The first idea which this arrangement presented to my mind, was that of pigs in an autumnal night, stowed in the angle of a “Virginia fence.”

Having beaten away the wall of the hill, a layer of light brown spongy substance was seen, its structure irregularly cellular, and enclosed in red moist clay of corresponding form; the “nurseries” of Smeathman. The cells contained young of different sizes; on the surface were visible numerous scattered minute white globular bodies, probably fungi. Messrs. Kirby and Spence suppose them to belong to the genus *Mucor*. But the mucoridei are generated from decayed animal and stercoreaceous matter. Without a microscopic examination, they seem to me to be assigned more naturally to the Trichocisti, perhaps *Trichia*, the pin head fungi, which are known to spring from decayed vegetable substance. It is highly probable that the material of which these nurseries are made, is at base vegetable matter. Their extent, as thus observed, is from the

base to two-thirds the height of the sides of the hill. Centrally to these, and lying immediately under the floor of the "dome," was a series of cellular work, entirely of clay, filled with a chestnut-brown substance, very moist, having the appearance of rasped or gnawed wood, and other vegetable matter. These are Smeathman's "magazines," and "food," which, with the nurseries, constitute almost two-thirds of the contents of the structure.

Throughout the nurseries were found young in different stages of growth; those in the external cells were smaller and mostly without rudimental wings; those in the interior cells were larger, with distinctly developed mandibles, and rudimentary wings generally, the *pupæ of soldiers*. The young in the interior of this cellular work, with a few exceptions, were assuming the yellow color which marks the head and thorax of the workers and soldiers in their perfect or active state; the exceptions were of a pure white.

As the larger passages were opened, a strong current of warm air from within was perceptible. I attempted to look down the "dome," but was compelled to withdraw immediately, my respiration being affected, and the glasses of my spectacles coated with a film of moisture; a strong, peculiar, but not unpleasant, odor was perceived. It was observed, that the deeper we penetrated, the more numerous became the young, and the more advanced were they in growth.

The structure called the "royal chamber" by Smeathman was discovered in position central in respect to the circumference of the hill, and about eighteen inches above the surface of the ground. Around and beneath it, was a connected series of clayey cellular work, in which were found the young, as before stated. The *chamber* was of an oblong shape, rounded at the ends and sides; flattened and thick above and below. It was supported on one side by two pillars, about $\frac{3}{4}$ of an inch in diameter; on the other, it was attached to the surrounding clay work. I accidentally broke open the enclosure, being misled by the statement of Smeathman, that it was situated on a level with the surface of the ground. The queen was discovered, surrounded by a large number of the larger laborers, a few soldiers, and some of the more advanced pupæ, all of whom were running rapidly round her, manifesting the greatest perturbation. The queen made great efforts at progression, constantly turning her head and thorax from side to side, but without moving in the least her huge abdomen. Her whole length was $4\frac{1}{2}$ inches. The king, evidently in great alarm, made repeated efforts to conceal himself under the abdominal folds of his consort.

On examining further the "royal chamber," a wide cavity was observed running horizontally along the upper part, or roof, externally, but without any signs of communication with the interior. On the under surface of the roof, or ceiling is a long depression, corresponding in shape to the body of the queen, which gives her that freedom of motion necessary to the extension of her eggs. This motion is compound, first in a longitudinal, then transverse direction, alternately elongating, contracting and widening her body, being marked with short, thick, transverse bands, the skin is thrown into folds, while these bands operate as so many fixed points, or centres of muscular action, forcing the eggs through their ducts to the place of exit.

For some time after exposure, the queen continued the expulsion of her eggs, but, not as I am inclined to think, to the usual extent. They were white and very minute, and left untouched by the workers, who evidently continued in a state of the greatest alarm.

The floor of the chamber was perfectly plane and smooth, exhibiting not the slightest impression from the body of the queen. The roof in the centre was

$\frac{3}{4}$ of an inch thick; the floor about $\frac{5}{8}$; at the line of conjunction about $\frac{1}{2}$. Posteriorly in the line of junction, between the roof and floor was a small aperture, sheltered from above by a spur of clay running downwards, which was the only way discovered of ingress and egress. It could not have admitted an insect larger than the soldiers, and even to them, as it then appeared, it must have been a "strait gate." The king could not have passed, and consequently not the queen. It had the appearance of having been repeatedly closed and opened by collections of clay around it.

That the queen is enclosed for life, is evident from the fact that she is, from her great size, incapable of progression of herself, or of being transported by any means within the power of the community.

On clearing away the refuse at the base of the hill, the orifices of the main passages under the basement were discovered; descending in a sloping direction, they led to large vacant rooms, made by the pillars supporting the arch-work; on which rests the interior of the structure. These pillars, or columns, were of an irregular, rounded shape, from $\frac{1}{2}$ to $2\frac{1}{2}$ inches in diameter, and stood on the solid ground about six inches high.

On visiting this hill the next morning, all the passages in that portion of the wall not dissected, were found well closed with fresh deposits of clay, and also a continuous layer spread over the remaining central cellular work. This was done during the night by the surviving members of the community for their protection against the cool air of the night, the rain, and hostile insects.

The opening of a hill is the signal for the gathering of all their foes,—ants, reptiles, &c.; hence the speedy closing of their various entrances, is a step of primary importance.

Another hill, previously dissected, was, after a time, so far repaired, as to be externally perfect. On taking it down again, though the cellular work was apparently restored, no queen was found, nor royal apartments; a few workers were all the insects discovered, and they were collected in the cells in the walls of the hill.

Hill 2d.—Opened Feb. 3d, 1847.

Circumference at base	26 ft. 10 in.
Height on the outer surface	8 ft. 6 in.

A diagonal section was made by a cross cut saw, beginning just below the upper floor of Smeathman.

The walls were much the thickest on the north side, nearly double those on the south, measuring $1\frac{1}{2}$ feet through.

It being in a locality where sand and gravel abounded, these materials were freely mixed with the clay.

The covered ways leading from the base to objects of plunder at a distance, were in this case larger and more numerous than any I have seen before. The main one measured 12 inches in diameter, and gave off several branches, which proceeded in various directions. These were traced to sticks, stumps and logs, which afforded them prey.

In this case, the laborers in the hill were generally of the smaller class, while those in the covered ways and in the stumps were larger, having strong stout jaws, well adapted to the gnawing of wood. The "royal chamber" was found raised about $1\frac{1}{2}$ feet above the level of the ground.

Hill 3d.—Circumference at base, 50 feet. Height, 14 feet.

The notes do not state whether this is the perpendicular height or not. Several fresh turrets were erected on the top, having a moist, deep red, granular appearance.

The structure called the "royal chamber," measured externally 10 inches in length, internally 8 inches. Its height from the level of the ground was 2 feet 8 inches. The length of the queen $4\frac{3}{4}$ inches.

Shrubs or small trees are frequently seen growing up through the hills. Such trees are never seen dead, consequently are not eaten by the insect.

On leave granted, Dr. John Neill presented an abstract of a paper written for the American Journal of Medical Sciences, entitled "Observations on the Occipital and Superior Maxillary Bones of the African Cranium." A peculiarity in the condyloid process of the occiput was pointed out, which is not generally noticed in works on Anatomy. It consists in a division of the process into two parts by a ridge or groove; showing a tendency in the basi-occipital bone of the fœtal, or young head, to be permanently retained. This peculiarity occurs oftener in the African than in any other head. In this respect there is an analogy to the lower orders of the vertebrata. The superior maxillary bone of the African head is also defective in a ridge which is continuous with the nasal process, and reaches to the anterior nasal spinal in the Caucasian head. In the African, the lower edge of the anterior nares is flat, and in this respect resembles the fœtal head, and the heads of inferior animals.

On leave granted, Dr. Morton made the following observations on the capacity of the skull in the different races of man.

Observations on the size of the Brain in various Races and Families of Man.

By SAMUEL GEORGE MORTON, M. D.

I have great pleasure in submitting to the Academy the results of the internal measurements of six hundred and twenty-three human crania, made with a view to ascertain the relative size of the brain in various races and families of Man.

These measurements have been made by the process invented by my friend Mr. J. S. Phillips, and described in my *Crania Americana*, p. 253, merely substituting leaden shot, one-eighth of an inch in diameter, in place of the white mustard-seed originally used. I thus obtained the *absolute capacity of the cranium, or bulk of the brain, in cubic inches*; and the results are annexed in all those instances in which I have had leisure to put this revised mode of measurement in practice. I have restricted it, at least for the purpose of my inferential conclusions, to the crania of persons of sixteen years of age and upwards, at which period the brain is believed to possess the adult size. Under this age, the capacity-measurement has only been resorted to for the purpose of collateral comparison; nor can I avoid expressing my satisfaction at the singular accuracy of this method, since a skull of an hundred cubic inches, if measured any number of times with reasonable care, will not vary a single cubic inch.

All these measurements have been made with my own hands. I at one time employed a person to assist me; but having detected some errors in his measurements, I have been at the pains to revise all that part of the series that had not been previously measured by myself. I can now, therefore, vouch for the accuracy of these multitudinous data, which I cannot but regard as a novel and important contribution to Ethnological science.

I am now engaged in a memoir which will embrace in detail the conclusions that result from these data; meanwhile I submit the following tabular view of the prominent facts.

The measurements of children, idiots and mixed races are omitted from this table, excepting only in the instance of the Fellahs of Egypt, who, however, are a blended stock of two *Caucasian* nations,—the true Egyptian and the intrusive Arab, in which the characteristics of the former greatly predominate.

No mean has been taken of the *Caucasian race** collectively, because of the very great preponderance of Hindu, Egyptian and Fellah skulls over those of the Germanic, Pelasgic and Celtic families. Nor could any just *collective* comparison be instituted between the *Caucasian* and *Negro* group in such a table, unless the small-brained people of the latter division (Hottentots, Bushmen and Australians) were proportionate in number to the Hindoos, Egyptians and Fellahs of the other group. Such a computation, were it practicable, would probably reduce the *Caucasian* average to about 87 cubic inches, and the *Negro* to 78 at most, perhaps even to 85, and thus confirmatively establish the difference of at least nine cubic inches between the mean of the two races.*

Large as this collection already is, a glance at the Table will show that it is very deficient in some divisions of the human family. For example, it contains no crania of the Eskimaux, Fuegians, Californians or Brazilians. The skulls of the great divisions of the *Caucasian* and *Mongolian* races are also too few for satisfactory comparison, and the Slavonic and Tehudic (Finnish) nations, together with the Mongol tribes of Northern Asia and China, are among the especial *desiderata* of this collection.

Among the facts elicited by this investigation are the following :

1. The Teutonic or German race, embracing, as it does, the Anglo-Saxons, Anglo-Americans, Anglo-Irish, &c., possess the largest brain of any other people.
2. The nations having the smallest heads, are the ancient Peruvians and Australians.
3. The Barbarous tribes of America possess a much larger brain than the demi-civilized Peruvians or Mexicans.

*It is necessary to explain what is here meant by the word *race*. Further researches into Ethnographic affinities will probably demonstrate that what are now termed the *five races* of men, would be more appropriately called *groups*; that each of these groups is again divisible into a greater or smaller number of primary races, each of which has expanded from an aboriginal nucleus or centre. Thus I conceive that there were several centres for the American group of races, of which the highest in the scale are the Toltecan nations, the lowest the Fuegians. Nor does this view conflict with the general principle, that all these nations and tribes have had, as I have elsewhere expressed it, a common origin; inasmuch as by this term is only meant an indigenous relation to the country they inhabit, and that collective identity of physical traits, mental and moral endowments, language, &c., which characterize all the American races. The same remarks are applicable to all the other human races; but in the present infant state of Ethnographic science, the designation of these primitive centres is a task of equal delicacy and difficulty. I may here observe, that whenever I have ventured an opinion on this question, it has been in favor of the doctrine of *primeval diversities* among men,—an original adaptation of the several races to those varied circumstances of climate and locality, which, while congenial to the one are destructive to the other; and subsequent investigations have confirmed me in these views. See *Crania Americana*, p. 3; *Crania Egyptiaca*, p. 37; *Distinctive Characteristics of the Aboriginal Race of America*, p. 36; *Silliman's American Journal of Science and the Arts*, 1847; and my *Letter to J. R. Bartlett, Esq.*, in Vol. 2 of the Transactions of the Ethnological Society of New York.

4. The ancient Egyptians, whose civilization ante-dates that of all other people, and whose country has been justly called "the cradle of the arts and sciences," have the least-sized brain of any Caucasian nation, excepting the Hindoos; for the small number of Semitic heads will hardly permit them to be admitted into the comparison.

5. The Negro brain is nine cubic inches less than the Teutonic, and three cubic inches larger than the ancient Egyptian.

6. The largest brain in the series is that of a Dutch gentleman, and gives 114 cubic inches; the smallest head is an old Peruvian, of 58 cubic inches; and the difference between these two extremes is no less than 56 cubic inches.

7. The brain of the Australian and Hottentot fall far below the Negro, and measures precisely the same as the ancient Peruvian.

8. This extended series of measurements fully confirms the fact stated by me in the *Crania Americana*, that the various artificial modes of distorting the cranium, occasion no diminution of its internal capacity, and consequently do not affect the size of the brain.

ELECTION.

Francis P. Porcher, M. D. of Charleston, South Carolina, was elected a *Correspondent* of the Academy.

October 2d.

Dr. BRIDGES in the Chair.

Letters were read:

From the Royal Bavarian Academy of Sciences, dated Munich, Feb. 1, 1849, acknowledging the receipt of recent publications of this Society.

From the Secretary of the Lyceum of Natural History of New York, dated September 26th, 1849, acknowledging the receipt of the last number of the Journal of the Academy.

From Mr. A. H. Morse, of New York, dated Sept. 15, 1849, offering for sale a skeleton and skin of *Manatus*.

From Wm. F. Van Amringe, Esq., addressed to Dr. Morton, dated New York, Sept. 12th, 1849, proposing a new system of Zoological Classification, which was referred to Drs. Wilson, Leidy and Zant-zinger.

October 9th.

Dr. McEVEN in the Chair.

Letters were read:—

From the Secretary of the American Philosophical Society, dated Sept. 24th, 1849, acknowledging the receipt of No. 3, Vol. 1, Journal of the Academy.

From William Hembel, Esq., dated October 4th, 1849, accompanying his donation of 41 vols. of the *Transactions* of a London Society for the encouragement of arts, manufactures, &c.—received this evening.